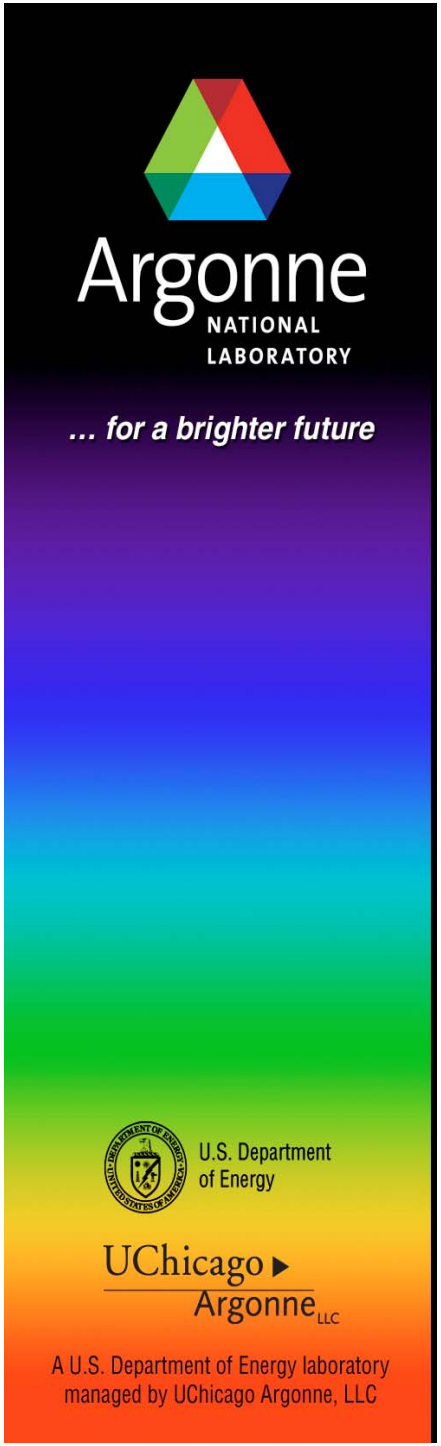

Demonstration of GREET1.7 Simulations

III. Uncertainty Analysis with Stochastic Simulations

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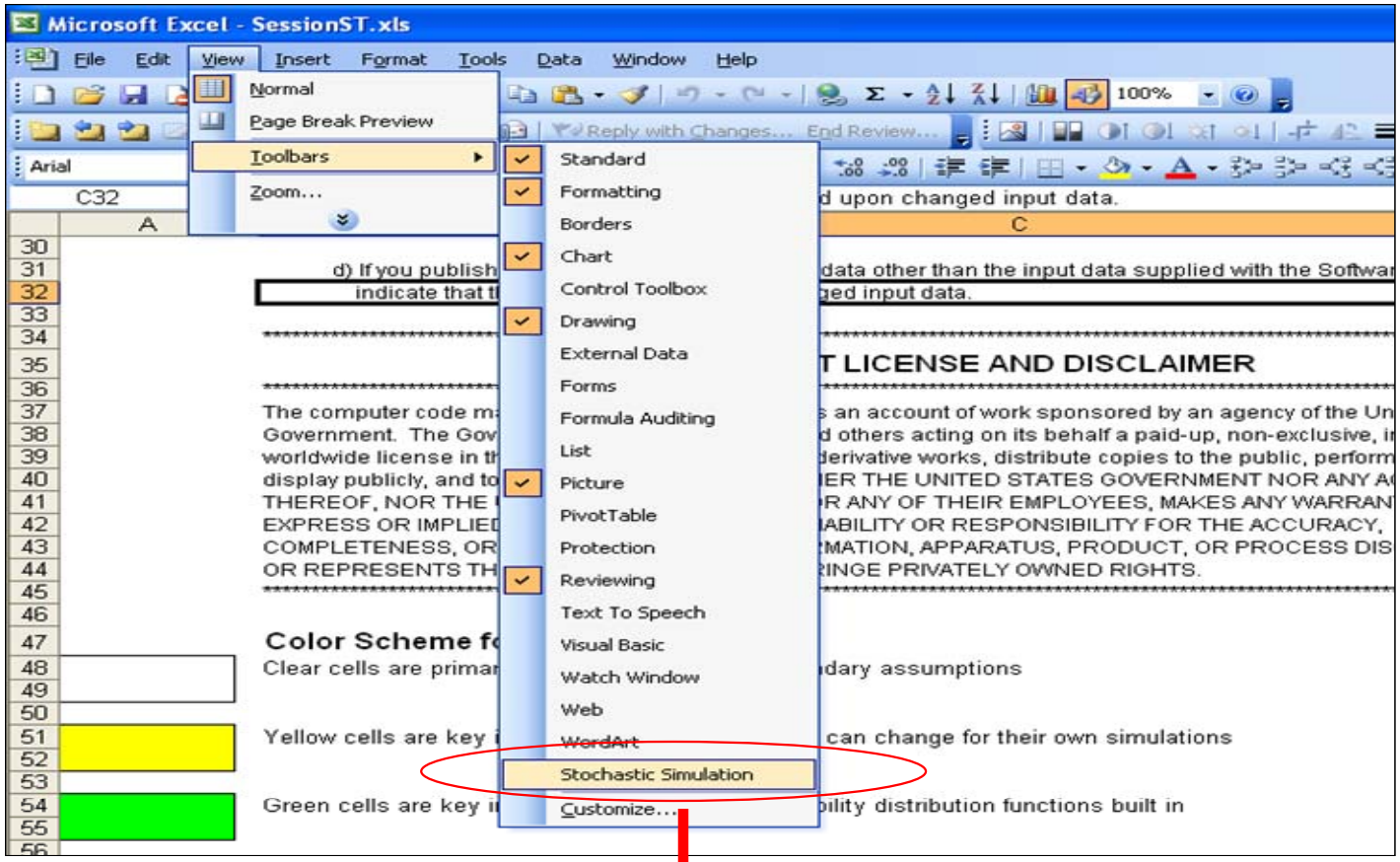
GREET User Workshop
Argonne, IL, June 25-26, 2007

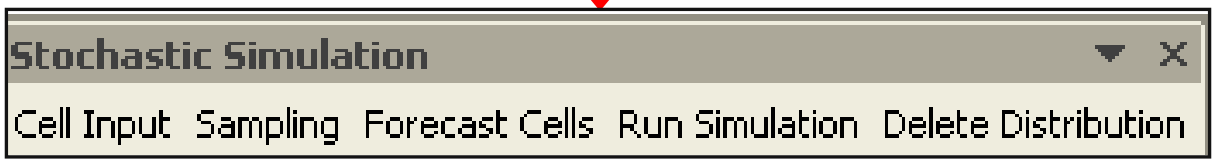
Before Conducting a Stochastic Simulation Run, the user must make sure that a Microsoft Office XP Web Component is installed on your computer:

Go to Windows website (below) to download the file "owc10.exe":
http://www.microsoft.com/downloads/details.aspx?FamilyID=982b0359-0a86-4fb2-a7ee-5f3a499515dd&displaylang=en

When the download is complete, double-click on the file icon and follow the on-screen installation instructions.

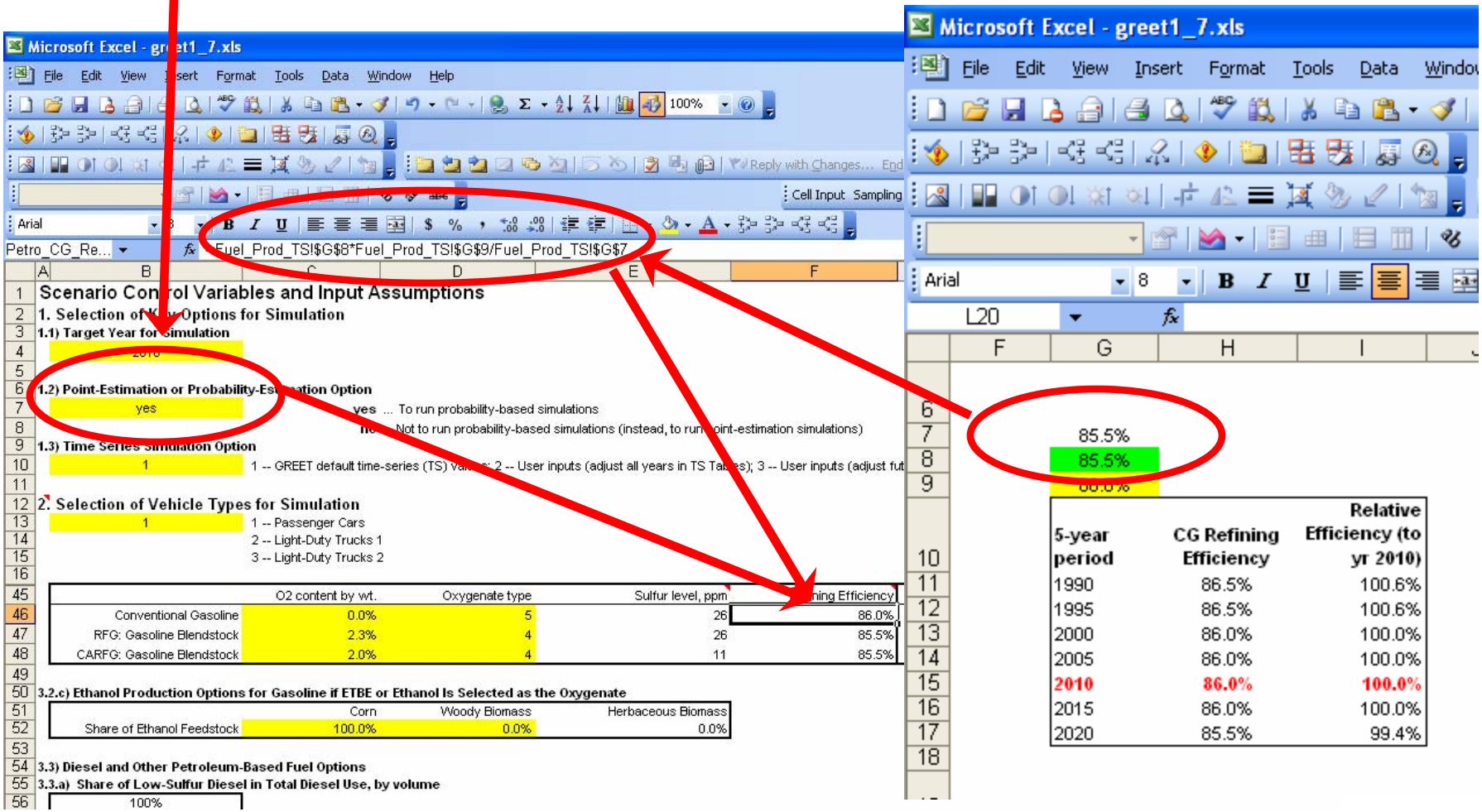
Loading the Stochastic Simulation Tool into GREET





For those users could not find the stochastic simulation tool in the *toolbars*, you'll need to go to *Tools>Add-Ins>Browse>* to reload the file "STOCHASTIC.xla", which is in the GREET1.7 folder.

Select YES prior to a Specific GREET Stochastic Simulation

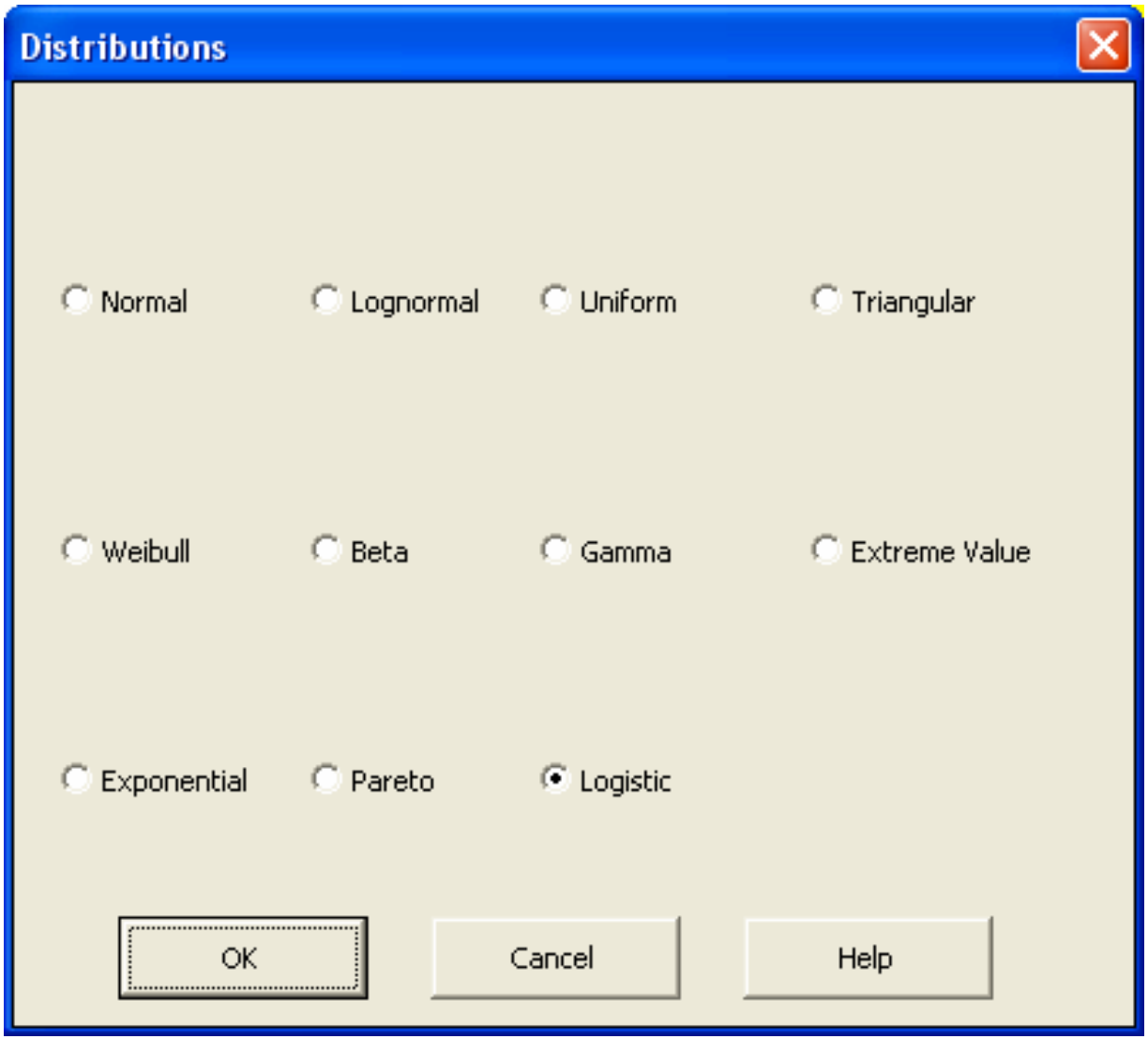


The cells with distribution curve (in green in GREET) and mean value of the distribution curve (immediately above the green cell, which is used to adjust the default curve) are linked to the calculating cell ONLY AFTER you select YES in section 1.2 in the *Inputs* sheet.

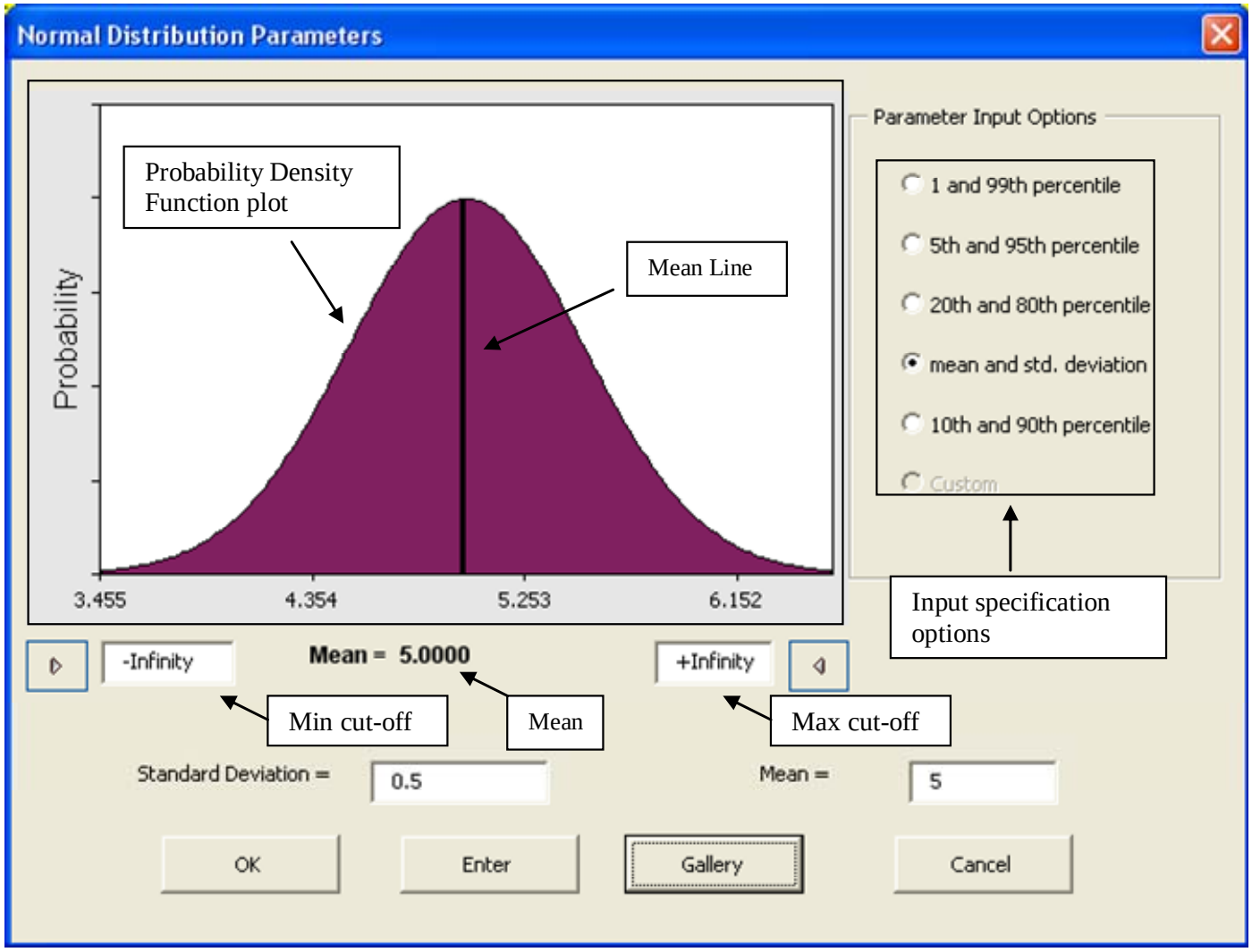
The Steps to Conduct a Stochastic Simulation Run

- **Assign probability distribution functions to the input variables**
- **Specify the number of samples required and the sampling technique**
- **Define the forecast variables**
- **Propagate the uncertainties**
- **Statistically analyze the outputs**

The Stochastic Simulation Tool Contains Eleven Probability Distribution Functions For a New Variable

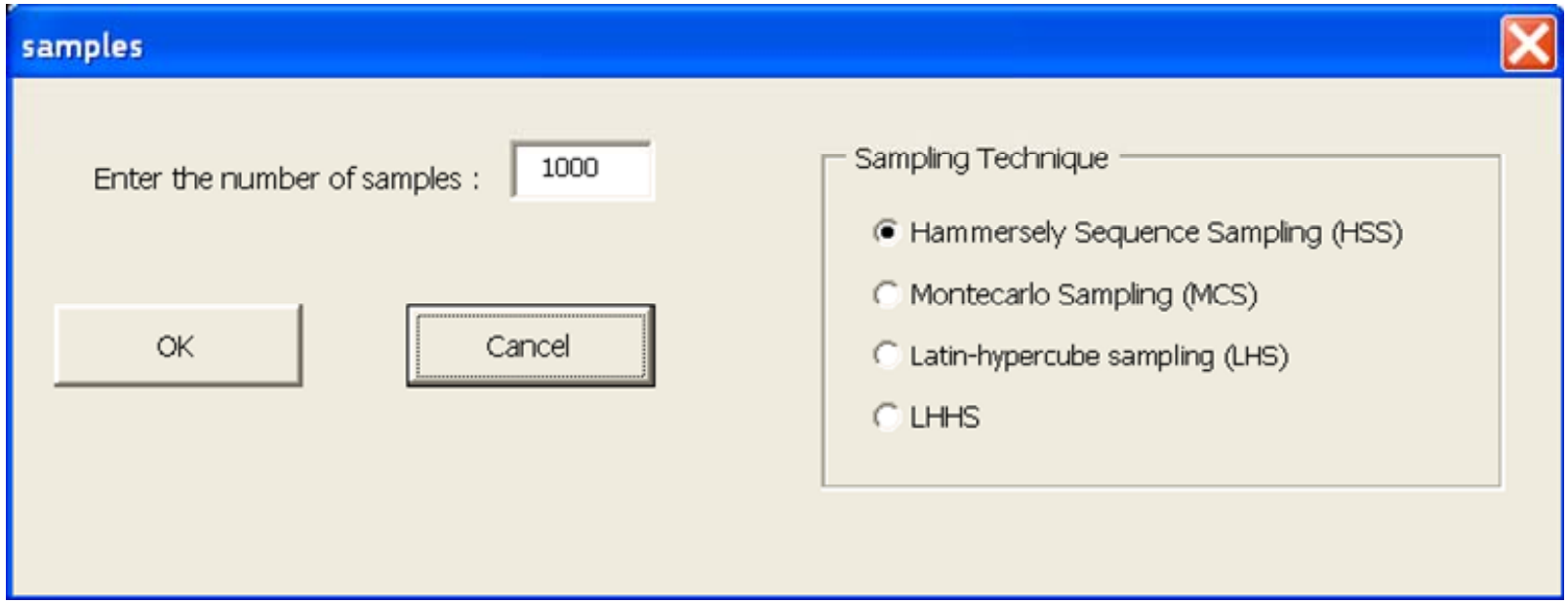


An Example of Input Parameter Specification Window for the Normal Distribution

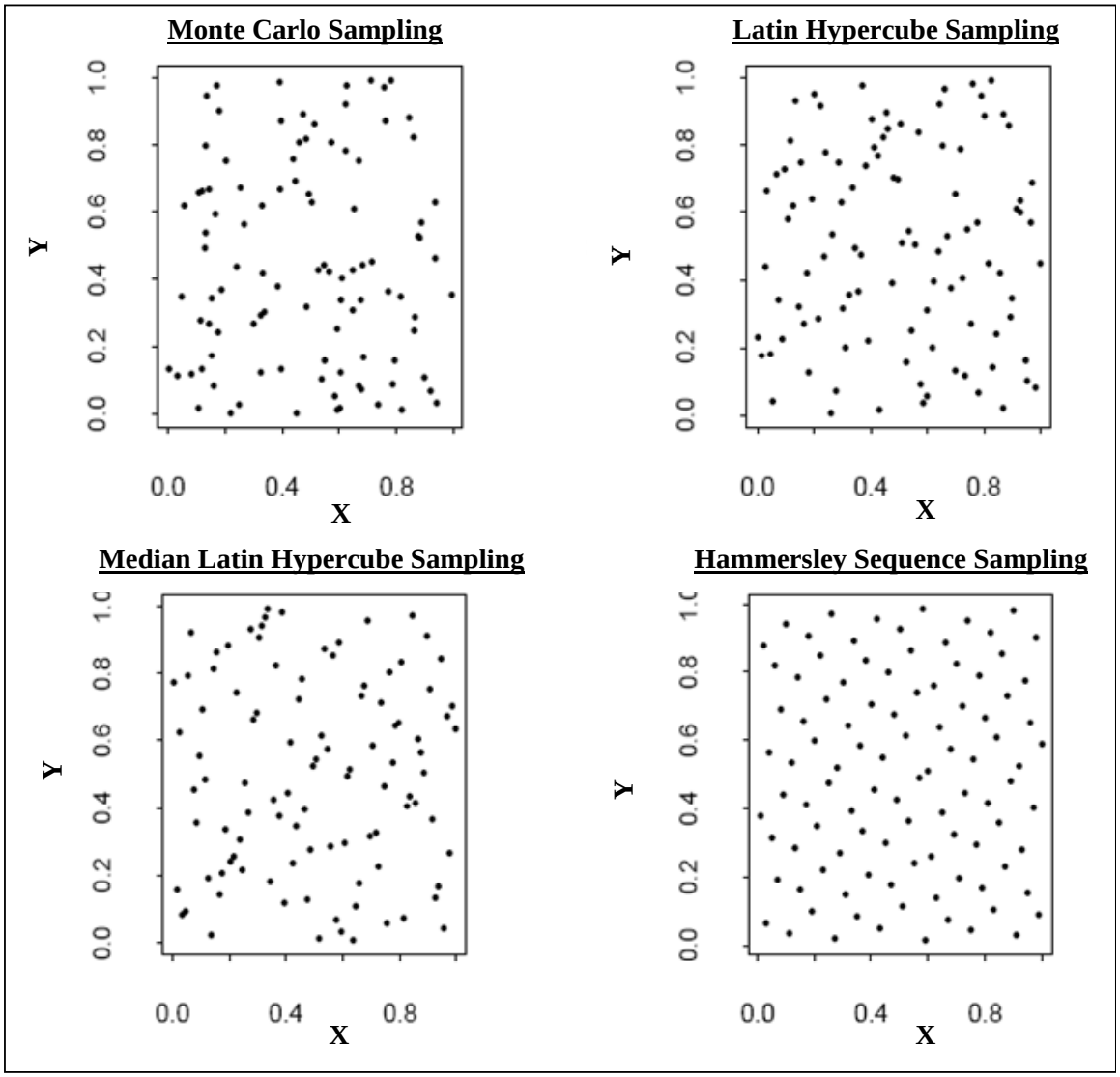


The Stochastic Simulation Tool Incorporates Four Sampling Techniques

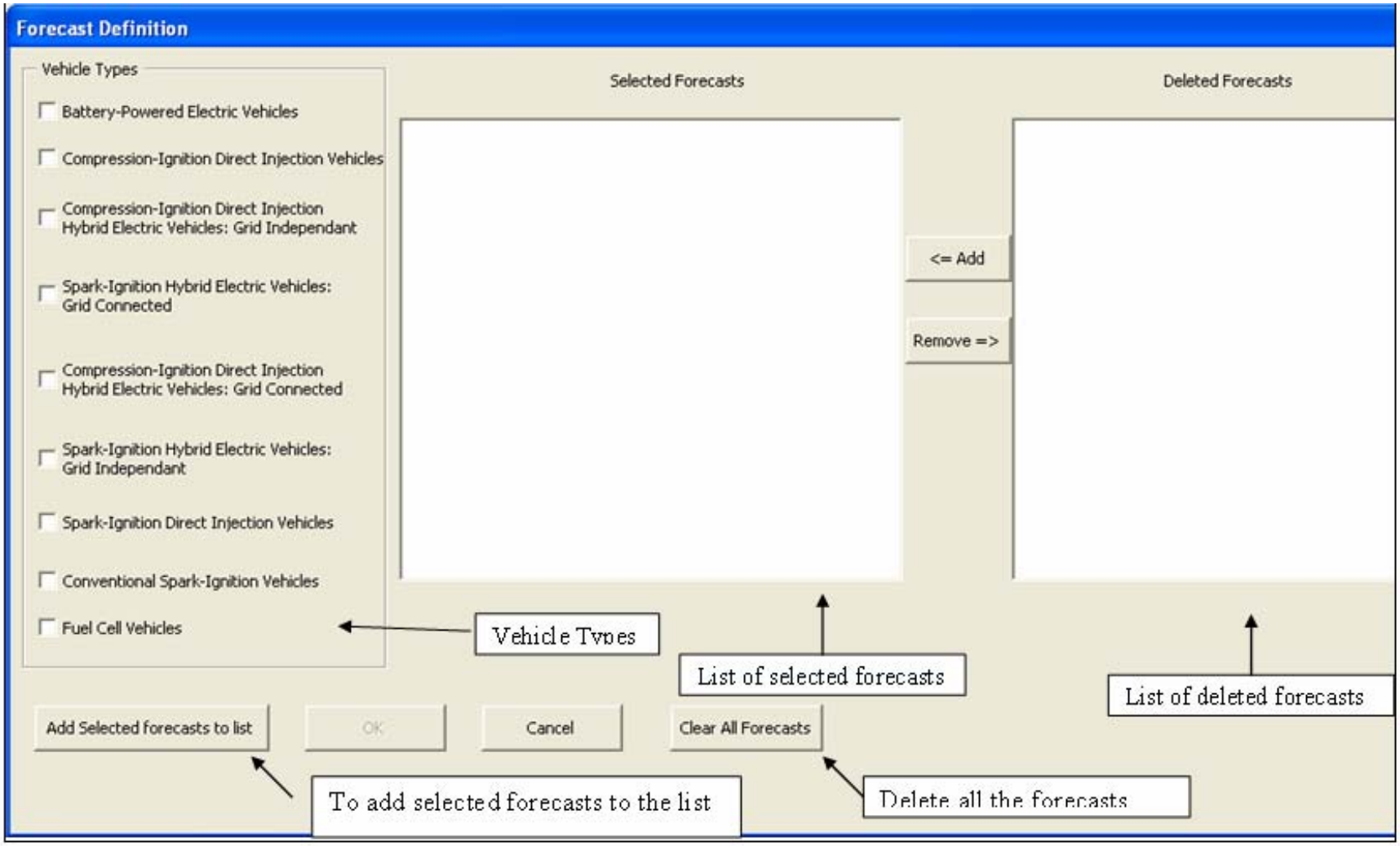
- **Monte Carlo Sampling (MCS)**
- **Median Latin Hypercube Sampling (MLHS)**
- **Hammersley Sequence Sampling (HSS)**
- **Latin Hypercube Hammersley Sampling (LHHS)**



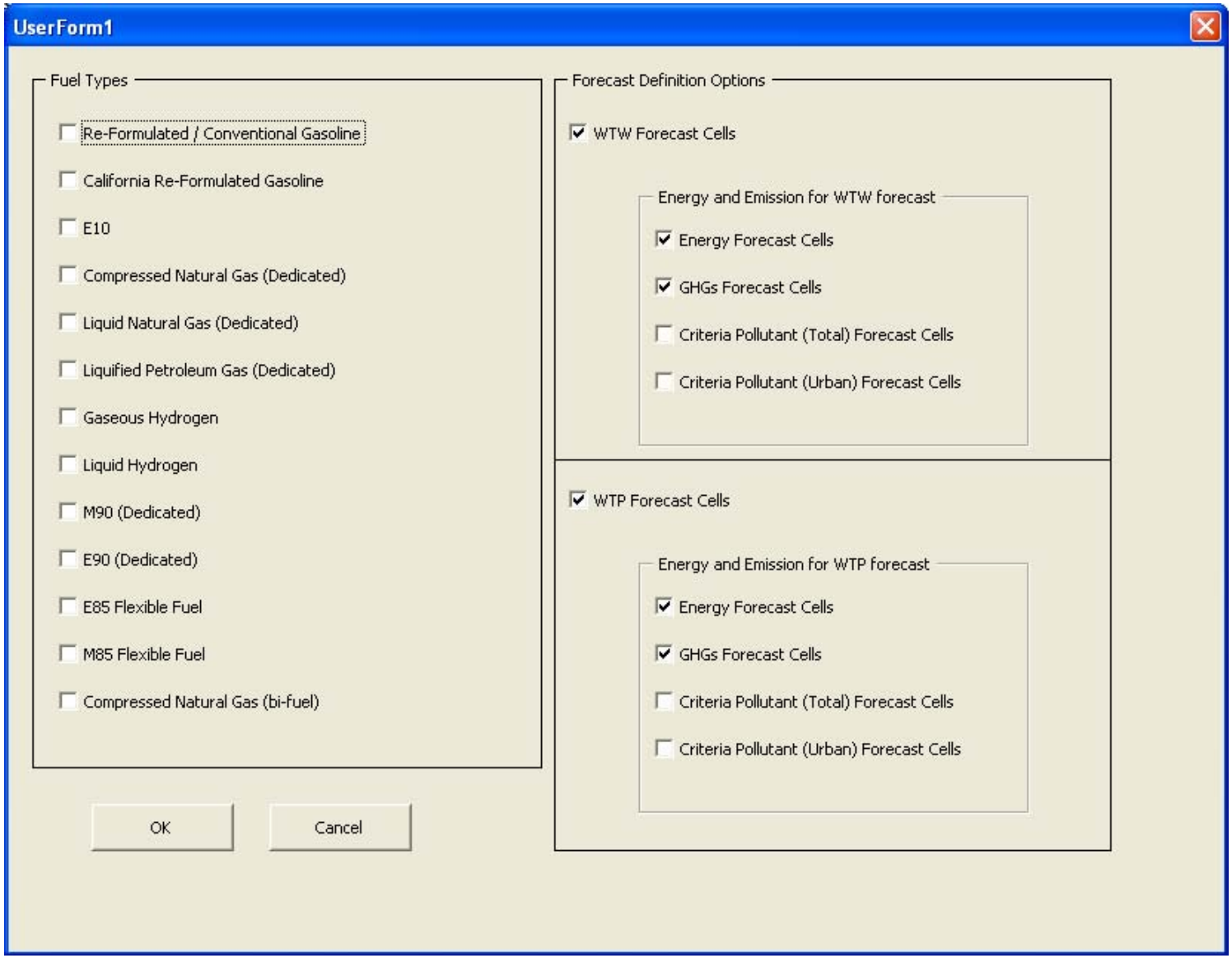
The Number of Samples for Each Sampling Technique Needs to Be Determined Carefully



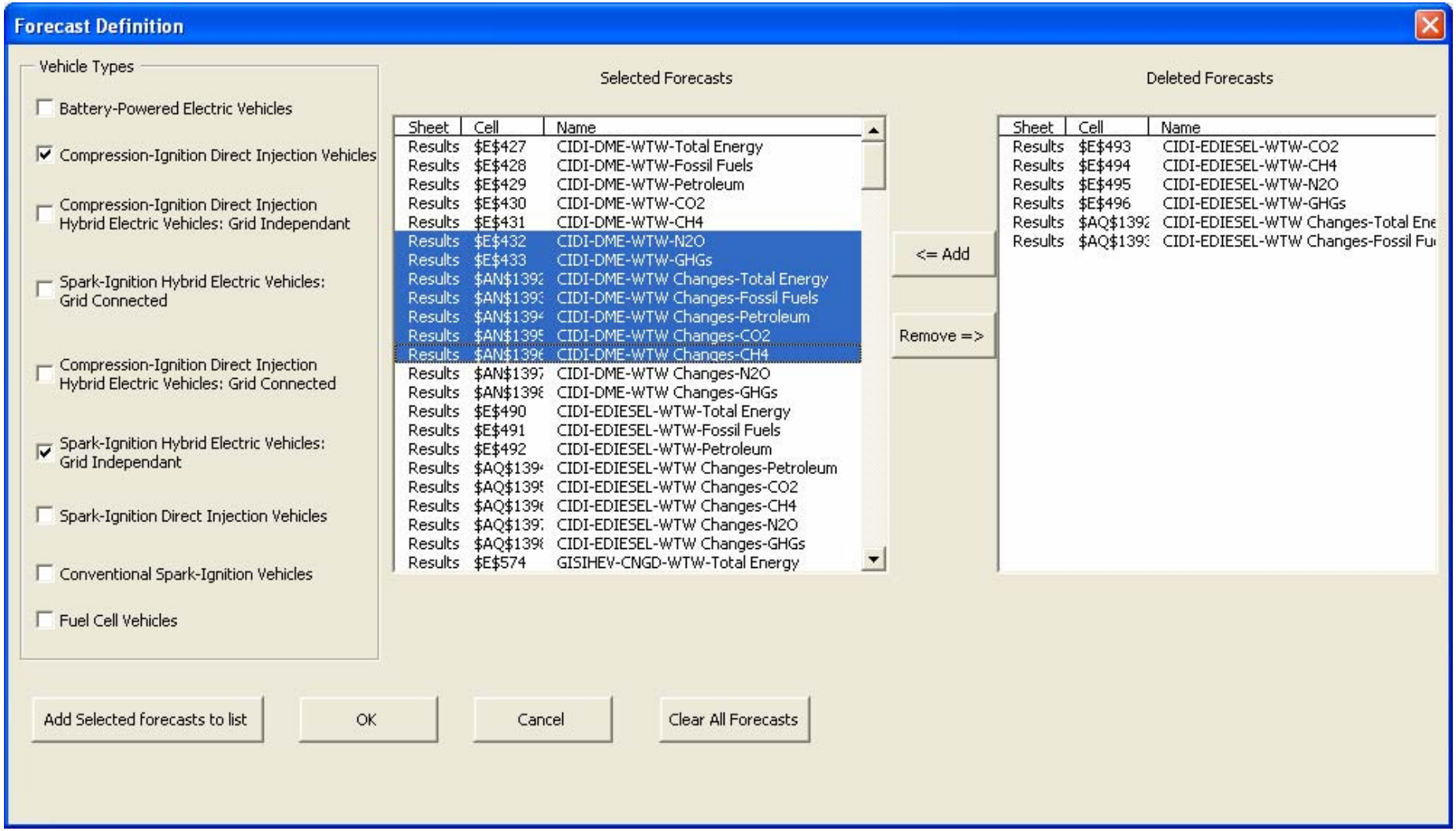
Define the Forecast Variables: 1) Select Vehicle Technologies



Define the Forecast Variables: 2) Select Fuel Types and 3) Select Energy/Emission Items



Define the Forecast Variables: 4) Add or Remove Individual Forecast Variables



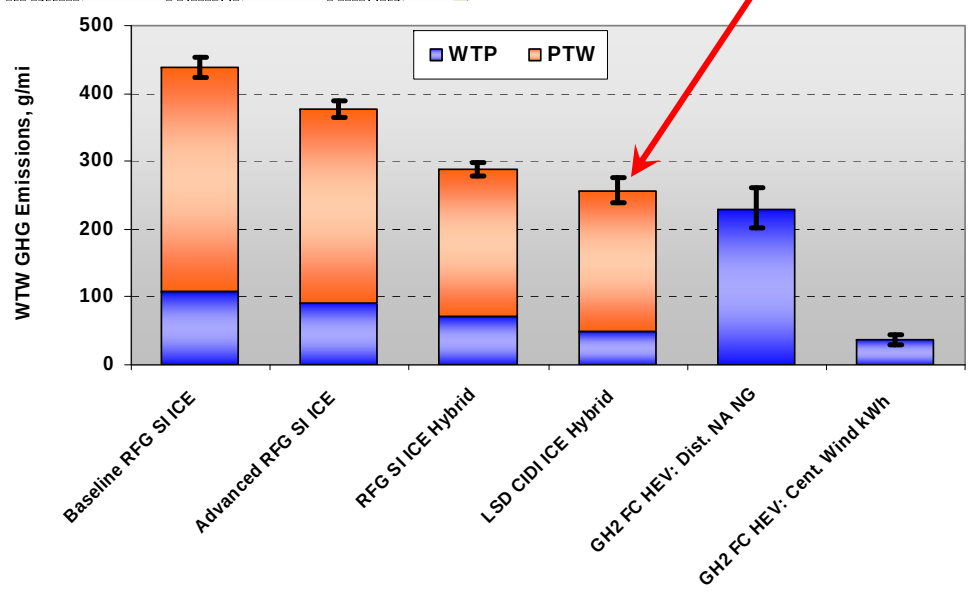
Statistically Analyzing the Outputs after Each Stochastic Simulation Run Is Required

Step 1: the stochastic simulate tool will automatically generate the results for each sample after the run is completed .

Step 3: with the statistical results, the user may manually draw graphs (e.g., the uncertainty range between the P10 and P90 values in the demo chart below).

Microsoft Excel - Book6

	A	B	C	D	E	F	G
1		EV-Electricity-WTW-Total Energy	EV-Electricity-WTW-Fossil Fuels	EV-Electricity-WTW-Petroleum	EV-Electricity-WTW-CO2	EV-Electricity-WTW-CH4	EV-Electricity-WTW-N2O
2		3321.399464	2903.273558	104.0725773	284.3042485	0.377779647	0.004126539
3		3163.628235	2765.352496	99.08984517	264.1939912	0.359611648	0.003917362
4		3079.852945	2692.116244	96.43835883	254.2983063	0.350103763	0.003828103
5		3238.052196	2830.417478	101.4902298	263.778169	0.3681206	0.00399349
6		3140.147283	2744.825733	98.35458792	252.1844079	0.357233623	0.003919769
7		3043.772242	2660.582457	95.3074409	254.6315965	0.346030693	0.003760875
8		3200.222875	2797.343163	100.2726682	264.5720268	0.363841316	0.003972926
9		3116.192323	2723.887281	97.57959977	254.5408613	0.35435255	0.003829408
10		2986.787116	2610.767386	93.50614537	240.9781668	0.339812086	0.003739753
11		3171.191209	2771.966214	99.33162812	265.7564495	0.3605604	0.003923285
12							
13	Mean	3146.124589	2750.053201	98.54430814	259.923823	0.357744633	0.003901151
14	S.D.	96.73637538	84.56405135	3.06244272	11.50163109	0.010987817	0.000116327
15	P0	2986.787116	2610.767386	93.50614537	240.9781668	0.339812086	0.003739753
16	P10	3038.07373	2655.60095	95.12731134	251.0637838	0.345408833	0.003758762
17	P20	3072.636804	2685.809487	96.21217524			
18	P30	3105.290509	2714.35597	97.23722749			
19	P40	3130.565299	2736.450352	98.04459266			
20	P50	3151.887759	2755.089115	98.72221654			
21	P60	3166.653425	2767.997983	99.18655835			
22	P70	3179.900709	2779.579299	99.61394014			
23	P80	3207.78874	2803.958026	100.5161805			
24	P90	3246.386923	2837.703086	101.7484646			
25	P100	3321.399464	2903.273558	104.0725773			



Step 2: the stochastic simulate tool will automatically generate the statistical results, e.g., mean value, standard deviation, P50, etc., to summarize the observation of all samples.

It may take several minutes to more than an hour to finish a particular stochastic simulation run depending on many factors, such as the number of forecast cells selected, the number of samples selected, and the hardware configuration of your computer.